Abstract Submitted
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Adjustment of mean velocity and turbulence due to a finite-size wind farm in a neutral ABL - A LES study VARUN SHARMA, cole Polytechnique Fdrale de Lausanne, MARC B. PARLANGE, University of British Columbia, Vancouver, MARC CALAF, University of Utah, Salt Lake City — Large-eddy simulation (LES) has become a well-established tool to simulate and understand the interaction between wind farms and the atmospheric boundary layer (ABL). A popular simulation technique considers wind turbines as actuator disks and simulates 'infinite' wind farms due to periodic boundary conditions in the horizontal directions. These simulations have indicated the presence of a fully developed internal boundary layer (IBL) due to 'wind farm roughness', which has been shown to have important implications, especially in stratified flow conditions. However, the relationship between the length of the wind farm and the resulting IBL vis-à-vis the asymptotic IBL and its relevance in real-world wind farms is not well understood at present. To address this issue, simulations of wind farms with different horizontal extents are performed in a neutral ABL using an extremely elongated computational domain. Results focus on identifying length scales defining the adjustment of the ABL to a new equilibrium within the wind farm and comparing it to the infinite wind farm case. Furthermore, analyses shall be extended upstream as well as downstream of the wind farm to determine the 'impact' region and the 'exit' region of the wind farm.

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